REMARKS

Claims 9-10 and 14-22 remain in the application. Claims 14-22 are newly added but do not contain any new matter. Claim 9 has been rewritten in independent form. The cancellation of claims 1-8 herein moots the need to file a Terminal Disclaimer.

The present invention results from the discovery that by utilizes an LED module which regulates the current and/or voltage supplied to an LED, the LED modules could be easily replaced even if the LED bare chips within the replacement LED modules had different specifications from the original LED modules. Furthermore, by providing an LED module which regulated the current and/or voltage supplied when the temperature of the LED module rose, degradation of the LED bare chips can be reduced and the life of LED modules can be prolonged.

The Office Action rejected Claim 9 under 35 U.S.C. §103(a) as being unpatentable over *Yamamoto* (U.S. 2002/0088983, hereinafter "*Yamamoto*") in view of *Gaines* (U.S. 6,998,594, hereinafter "*Gaines*").

LED technology has constantly improved in terms of performance and efficiency. Thus, LED chips which are created today may not have the same specification in terms of voltage and current requirements as LED bare chips which were created yesterday or which will be created in the future. This can lead to problems when LED bare chips and/or the LED modules which they are placed on need to be replaced. If the LED bare chips use a different current and/or voltage, the whole system of LED modules will have to be replaced or else the performance of not only the replacement LED bare chips may be severely compromised but also the performance of the other original LED bare chips and LED modules. This can be extremely expensive since not only will there be costs associated in terms of obtaining the physical parts, but there will also be

labor costs with respect to removing the LED module right away. This problem is compounded when the LED module is mounted such that it is not easily removed or accessed.

Also, when a single LED module is non-functional, oftentimes the other LED modules in a lighting device will also become non-functional due to the restriction of current flowing to all of the LED modules because of the non-functional LED module. This is problematic because the lighting device will fail to function if a singular LED module is non operational. This renders the whole lighting device inoperative.

Another problem occurs when the temperature in an LED module increases, because any increase in temperatures can severely degrade the LED bare chips in other LED modules.

Therefore some of the objectives of the present invention are to provide an LED module which can easily be replaced, which reduces the effects of an inoperative LED module, and which also reduces the effects of thermal degradation. The LED module 13 includes a main substrate 130 on which the constant current circuit unit 13a and the LED mounting unit 13b are formed. (Spec. Pg. 12, lns. 13-17, Fig. 4). The main substrate can be composed of an insulative layer 130a of resin or similar material formed on a metal layer 130b of Al or similar material. The insulative layer 130a and the metal layer 130b are thermally bonded and thus the main substrate 130 has a favorable thermal conductivity rate of 1Wmk to 10WmK. (Spec. Pg. 12, lns. 18-23). The main substrate 130 is thus superior in terms of thermal conductivity to a substrate made of resin only. (Spec. Pg. 12, lns. 24-25).

The constant current circuit unit 13a is composed of a sub-substrate 131 on which a conductive land 132 is formed, a resistor 133, and two transistors 134 and 135. The constant current circuit 13a is attached to the main substrate 130 using a resin or other similar material. (Spec., pg. 13, lns. 17-24; Fig. 4). The constant current circuit can maintain a constant current to

the LED module. Thus, even if the LED bare chips mounted on the LED module differ in terms of current rating, the LED module can still perform with stable luminous intensity. This allows for replacement of an LED module whose LED bare chip specifications differ from those at the time the LED lighting device 1 was designed. (Spec. Pg. 16, lns. 8-23).

Also, since the LED modules can be connected in parallel and have respective constant current circuit units, it is unnecessary for all of the LED modules to be mounted on the module socket. Instead, it is sufficient for only one or two of the LED modules to be mounted in order for the lighting device to be operable. (Pg. 11, ln. 28 – Pg. 12, ln. 7).

Furthermore, the LED module 15 can have a thermistor 15T in a constant current circuit 15a which can aid in monitoring and controlling the LED mounting unit 15b when the temperature rises above a predetermined level accordingly. (Pg. 19, ln. 17 - pg. 20, ln. 4; Fig. 8).

Yamamoto's objective is to provide a compact multichip module by reducing the need for large heat fins. (¶ 0011). It accomplishes this by utilizing a lead frame 9 constituting an island portion 4 which absorbs heat generated by the light-emitting device 2 as it generates light and dissipates the heat to the air. (¶ 0013).

The Office Action admits that *Yamamoto* does not teach or suggest "a thermal element unit connected to the luminous intensity stabilization circuit, and including a thermal element and a first comparator provided in a vicinity of an area in which the one or more LED bare chips are mounted."

Yamamoto also does not teach "a luminous intensity stabilization circuit connected electrically to the power supply terminal and the LED mounting unit." Yamamoto only discloses that "the monolithic LSI 3 controls the current flowing through the LED 2, and thereby controls

the amount of light emitted from the LED 2." However, Yamamoto does not disclose why or how the LSI 3 controls the amount of light emitted from the LED 2. (¶ 0028).

In contrast, in the present invention "the luminous intensity stabilization circuit reduces or stops current to the one LED module independently from any other LED modules in the plurality of LED modules, according to a judgment signal from the first comparator based on detected temperature information from the thermal element" when "at least one of the LED bare chips in any one of the LED modules rises in temperature to a predetermined temperature or higher." Thus, the luminous intensity stabilization circuit can reduce or stop the current from flowing to the one LED module independently from other LED modules in order to prevent heat degradation of the other LED modules due to excessive heat from one LED module. It also allows for the LED modules to easily be replaced and to maintain the utility of the lighting device as a whole.

By allowing one LED module to be non-functional while allowing the other LED modules to be functional the utility of the lighting device is increased because one non-functional LED module will not shut down the entire lighting device.

Gaines relates to a method of maintaining chromatic light characteristics from a multi-chip LED package. (Col. 1, ln. 7-9). It accomplishes this by utilizing "at least one enclosure positioned to receive an amount of light output form the plurality of LEDs" and "at least one light sensor positioned in the enclosure to measure the light output from the plurality for LEDs" and "a controller operably connected to the LED chips to control current to the LED chips based on the measured light." It also has a temperature sensing device 120 operably connected to the control system 130. It can measure the temperature of the LEDs and as long as the temperature

remains constant, the current flow rate will be maintained. (Col. 3, lns. 27-42, Col. 4, lns. 31-38).

Gaines does not teach or suggest a "a thermal element unit connected to the luminous intensity stabilization circuit, and including a thermal element and a first comparator provided in a vicinity of an area in which the one or more LED bare chips are mounted." In *Gaines*, the temperature sensing device is disclosed to only be a "thermocouple or any other suitable means known in the art to measure the temperature of a component" and only that the control system 130 will alter the current flow to the LED as required. (Col. 3, lns. 29-31, Col. 4 lns. 36-38).

Gaines is only concerned with sensing temperature from the LED in with respect to the chromatic scale of the LED and not with any potential disastrous effects of rising temperatures on the LED or the ability to use LEDs with different specifications. (Col. 4, lns. 6-18). In contrast, the present invention is concerned with the potential damage to the LEDs by abnormal heat conditions and also the ability to use LEDs with different specifications. (Spec. pg. 3, lns. 22-26; pg. 31, lns. 7-19).

Gaines also does not expressly disclose "a luminous intensity stabilization circuit connected electrically to the power supply terminal and the LED mounting unit." Gaines only discloses that it alters the current flow to vary the LED color and intensity of the light emitted from the multi-chip package. (Col. 4, lns. 19-20).

In contrast, in the present invention, the "luminous intensity stabilization circuit reduces or stops the current to the one LED module independently from other LED modules, according to a judgment signal from the first comparator based on detected temperature information from the thermal element." Therefore, the luminous intensity stabilization circuit can reduce or stop the current from flowing to the one LED module independently from other LED modules in

order to prevent heat degradation of the other LED modules due to excessive heat from one LED module.

The present invention also allows for the LED modules to easily be replaced while maintaining the functionality of the LED device as a whole. By allowing one LED module to be non-functional while allowing the other LED modules to be functional the utility of the lighting system is increased because one non-functional LED module will not shut down the entire lighting device.

There is also no motivation to combine the two inventions. An inventor seeking to provide a compact multichip module by reducing the need for large heat fins would not look to a method of maintaining chromatic light characteristics from a multi-chip LED package. Also, even if the inventions were combined, however improperly, the hypothetical combination would still not disclose the present invention. The hypothetical combination would not have "a thermal element unit connected to the luminous intensity stabilization circuit, and including a thermal element and a first comparator provided in a vicinity of an area in which the one or more LED bare chips are mounted" or "a luminous intensity stabilization circuit connected electrically to the power supply terminal and the LED mounting unit."

Thus, Claim 9 has novelty and inventiveness over *Yamamoto* in view of *Gaines*.

The Office Action rejected Claim 10 under 35 U.S.C. §103(a) as being unpatentable over *Yamamoto* in view of *Sakamoto* (U.S. 6,489,637, hereinafter *Sakamoto*) and further in view of *Inoue et al.* (U.S. 6,975,813, hereinafter *Inoue*) and *Gaines*.

The arguments for patentability with respect to Claim 9 are repeated and incorporated herein.

As previously discussed, a major problem with LED modules is that the increase in temperature in one LED module could lead to the degradation of the LED chips in not only the singular LED module, but also the other LED modules.

Thus, another objective of the present invention is to provide an LED module which monitors and stabilizes the temperature of LED modules.

When the temperature of the LED mounting unit 18b is normal, the comparator 188 outputs an "H" signal to the logical circuit 120a in the module socket 120 via signal SM1. If the temperature of the LED mounting unit 18b is too high, such as when a short occurs, the comparator 188 outputs an "L" signal to the logical circuit 120a via signal SM1. If the logical circuit 120a receives any "L" signals at all from signal SM1, it will output an "L" signal to the constant voltage circuit unit 140 via signal SM2. (Spec. pg. 23, ln.27 – pg. 24, ln. 19; Figs. 11-13).

If the current in the LED bare chips 21c, the current detection unit 21c comprising a resister and a comparator 216b will output a "L" signal from SM3 to the logical circuit 217. If logical circuit 217 receives any "L" signals at all from detection units 21c, it will output an "L" signal to the constant voltage circuit unit 140. (Spec. pg. 30, ln. 8 – pg. 31, ln. 5; Fig. 14).

If the constant voltage circuit unit 140 receives an "L" signal from the logical circuit 120a via signal SM2, meaning there's a temperature abnormality, the transistor Q2 switches to off, and an output voltage of the output end O5 of the tertiary winding T3 of the output trans T is applied via the diode D1 and the resister R3 to the IC signal input terminal S1. The IC then stops output of the pulse signal from the signal output terminal S2, and stops the switching operation of the transistor Q1. This turns off transistor Q1 and accordingly, no current flows to the primary winding T1 of the output trans T, and the output of the secondary winding T2 and the

tertiary wiring T3 is substantially terminated. Thus, power is cut off and the LED bare chips in the LED modules 18, 19, and 20 are extinguished. (Pg. 28, ln. 20 – Pg. 29, ln. 21; Fig. 11, 13).

Similarly, if the voltage circuit unit 140 receives an "L" signal via signal SM4, it cuts off power to the LED bare chips in the LED modules 18, 19, and 20. (Spec., pg. 31, lns. 3 – 12).

By cutting off power in both scenarios, the present invention can prevent the heat radiating plate 30 from conducting heat caused by an excessive rise in temperatures in one of the LED mounting units in the plurality of LED modules and thus prevent raising the temperatures in the other LED modules. This can prevent the reduction in lifespan of the LED bare chips.

The Office Action admits that *Yamamoto* does not disclose "one constant voltage circuit operable to supply a constant voltage to each LED module, using power from a power supply source."

Yamamoto also fails to explicitly teach "one logical circuit electrically connected to the constant voltage circuit and the thermal element unit of each LED module." There is no indication that *Yamamoto* uses a logical circuit.

Sakamoto is a reference related to "a hybrid integrated circuit device, and more particularly to a light irradiation device in which a plurality of light emitting elements are found" for irradiating plants such as flowers or vegetables. (Col. 1, lns. 7-13). It seeks to reduce the problems caused on circuit boards from the heat of the LED 2. (Col. 1, lns. 43 – 60). It accomplishes by disposing a first flow-stopping means 36 made out of brazing material and a light transmitting resin substantially around an LED 10. (Col. 1, lns. 62 – lns. 67; Fig. 2). The flow-stopping means helps to reflect the light from the LED to prevent it from reaching the hybrid integrated circuit substrate 11. (Col. 5, lns. 1-21; Fig. 2).

The Office Action admits that *Sakamoto* does not teach or suggest "one constant voltage circuit operable to supply a constant voltage to each LED module, using power from a power supply source."

Sakamoto also does not disclose "one logical circuit electrically connected to the constant voltage circuit and the thermal element unit of each LED module." There is no indication that *Sakamoto* uses a logical circuit.

Inoue is a reference that is directed towards reducing the variations in the emitted light from a light emitting device. (Col. 3, ln. 24 – Col. 4, ln. 45). It accomplishes this by utilizing a photodetector to detect the output of the light-emitting device, a comparator to compare the light emitted from the light-emitting device to a reference, and a light control device which controls the light output of the light-emitting device in a discrete manner in accordance with the result of the comparison output such that the performance is within a window of a specified width. (Col. 3, ln. 24 – Col. 4, ln. 45).

Inoue does not disclose "one constant voltage circuit operable to supply a constant voltage to each LED module, using power from a power supply source." Inoue uses a constant voltage circuit to control the width of the window comparator. It utilizes a resistor with a temperature dependence in conjunction with the constant voltage circuit to reduce the window width without increasing the temperature. (Col. 15, lns. 14-20; lns. 37-45, lns. 49-55). Thus, it controls the voltage in relation with the temperature to ensure that the light is within a chromatic scale.

In contrast, the present invention utilizes the constant voltage circuit to reduce the power to the power supply terminal "such that the luminous intensity stabilization circuit reduces or stops current supplied to the LED mounting unit" when at least one LED module rises in

temperature to a predetermined temperature or higher. Thus, instead of reducing power for just one LED bare chips, the present invention reduces the power to the LED mounting unit to prevent the degradation of all of the LED bare chips due to abnormal temperatures.

Inoue also does not teach or suggest "one logical circuit electrically connected to the constant voltage circuit and the thermal element unit of each LED module." There is no indication that *Inoue* utilizes a logical circuit.

Gaines also does not recite "one constant voltage circuit operable to supply a constant voltage to each LED module, using power from a power supply source." There is no indication that *Gaines* utilizes a constant voltage circuit.

Gaines also does not possess the feature of "one logical circuit electrically connected to the constant voltage circuit and the thermal element unit of each LED module." There is no indication that *Gaines* utilizes a logical circuit.

Also, there is no motivation to combine the references. An inventor looking to (1) provide a compact multichip module by reducing the need for large heat fins in *Yamamoto* would not look to (2) an invention directed towards "a hybrid integrated circuit device, and more particularly to a light irradiation device in which a plurality of light emitting elements are found" for irradiating plants such as flowers or vegetables" in *Sakamoto*, (3) an directed towards reducing the variations in the emitted light from a light emitting device in *Inoue*, and (4) to a method of maintaining chromatic light characteristics from a multi-chip LED package in *Gaines*.

As the Examiner is aware, the hard question is whether the combination is based upon hindsight from the present teaching rather than what would be obvious apart from the present teaching to a person of ordinary skill in this field.

As set forth in *In re Kahn*, 441 F.3d 977, 987-988 (Fed. Cir. 2006):

> The motivation-suggestion-teaching test picks up where the analogous art test leaves off and informs the *Graham* analysis. [*Graham v. John Deere Co.*, 383 U.S. 1, 13-14 (1966).]
>
> To reach a non-hindsight driven conclusion as to whether a person having ordinary skill in the art at the time of the invention would have viewed the subject matter as a whole to have been obvious in view of multiple references, the Board must provide some rationale, articulation, or reasoned basis to explain why the conclusion of obviousness is correct. The requirement of such an explanation is consistent with governing obviousness law. . . .

* * *

A suggestion, teaching, or motivation to combine the relevant prior art teachings does not have to be found explicitly in the prior art, as "the teaching, motivation, or suggestion may be implicit from the prior art as a whole, rather than expressly stated in the references. . . . The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." However, rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, <u>there must be *some* articulated reasoning with *some* rational underpinning to support the legal conclusion of obviousness</u>. This requirement is as much rooted in the Administrative Procedure Act [for our review of Board determinations], which ensures due process and non-arbitrary decision making, as it is in §103.

Furthermore, even if the references were combined, however improperly, the resulting hypothetical combination still would not produce the present invention. The hypothetical combination would not have the features of "one constant voltage circuit operable to supply a constant voltage to each LED module, using power from a power supply source" or "one logical circuit electrically connected to the constant voltage circuit and the thermal element unit of each LED module."

Thus, Claim 10 has novelty and inventiveness over *Yamamoto* in view of *Sakamoto* and further in view of *Inoue* and *Gaines*.

With respect to Claim 14, *Yamamoto* does not teach or suggest "wherein each of the LED modules is individually detachable." There is no indication that each of the LED modules is individually detachable.

Gaines does not disclose "wherein each of the LED modules is individually detachable." There is no disclosure that each of the LED modules is individually detachable.

Sakamoto does recite "wherein each of the LED modules is individually detachable." There is no teaching that each of the LED modules is individually detachable.

Inoue does not disclose "wherein each of the LED modules is individually detachable." There is no indication that each of the LED modules is individually detachable.

Thus Claim 14 has novelty and inventiveness over *Yamamoto* in view of *Sakamoto* and further in view of *Inoue* and *Gaines*.

With respect to Claim 19, *Yamamoto* does not teach or suggest "a current detection unit including a comparator connected to the one or more LED bare chips to detect a current amount" or "a logical circuit electrically connected to the constant voltage circuit and the plurality of current detection unit."

Gaines also does not disclose "a current detection unit including a comparator connected to the one or more LED bare chips to detect a current amount" or "a logical circuit electrically connected to the constant voltage circuit and the plurality of current detection unit."

Inoue does not recite "a current detection unit including a comparator connected to the one or more LED bare chips to detect a current amount" or "a logical circuit electrically connected to the constant voltage circuit and the plurality of current detection unit."

Sakamoto also does not feature "a current detection unit including a comparator connected to the one or more LED bare chips to detect a current amount" or "a logical circuit electrically connected to the constant voltage circuit and the plurality of current detection unit."

Katogi et al. is a reference that seeks to reduce the cost of controlling RGB lights which illuminate the ceiling and wall in desired colors. It accomplishes this by providing an illumination system, utilizing a first illumination unit comprising a pair of power supply contacts for connection to a commercial AC power source, a light source connected between the pair of power supply contacts, a control circuit connected in series to the light source to control electric current flowing through the light source, and a first connection cord connected to the light source. (¶ 0011).

It also has a second illumination unit comprising a light source and a first connection cord connected to the light source, such that the first connection cord of the first illumination unit and the first connection cord of the second illumination unit are connected to each other so that the light source of the first illumination unit and the light source of the second illumination unit are connected in parallel to each other. This allows electric power to flow to the second illumination unit (sub unit) via the first illumination unit (main unit) as well as to control the light source of the second illumination unit by the control circuit of the first illumination unit. Thus, the second illumination unit does not need its own power cable for direct connection to an outside power source such as the commercial AC power source. (¶ 0011).

Katogi also does not feature "a logical circuit electrically connected to the constant voltage circuit and the plurality of current detection unit." There is no indication that *Katogi* uses a "logical circuit" connected to the constant voltage circuit.

Katogi does not teach or suggest "a current detection unit including a comparator connected to the one or more LED bare chips to detect a current amount." The Office Action cited only to the PC 1-3 in Figure 4 as the current detection unit. However, PC 1-3 are only photo-couplers comprising an LED and a photo-transistor. When electric current flows through the LED in the photo-couplers, to emit light, the light is detected by the associated photo-transistor which activates the transistors Q 1-3. Thus, *Katogi* teaches a light detection unit, but not a current detection unit.

In contrast, in the present invention, the current detection unit 21c comprises a resister and a comparator 216b which will output a "L" signal from SM3 to the logical circuit 217 if there is any abnormal currents. If logical circuit 217 receives any "L" signals at all from detection units 21c, it will output an "L" signal to the constant voltage circuit unit 140. (Spec. pg. 30, ln. 8 – pg. 31, ln. 5; Fig. 14).

If the constant voltage circuit unit 140 receives an "L" signal, there is a current amount abnormality. The constant voltage circuit unit 140 will shot off power and the LED bare chips in the LED modules 18, 19, and 20 are extinguished. (Spec., pg. 31, lns. 3 – 12).

Thus, Claim 19 has novelty and inventiveness over *Yamamoto* in view of *Sakamoto* and further in view of *Inoue*, *Gaines*, and *Katogi*.

With respect to Claim 21, all arguments for patentability with respect to Claims 9, 10, and 14 are repeated and incorporated herein.

Claims 10, 14-18, 20, and 22 depend from and further limit independent Claims 9, 19, and 21 and are also allowable.

In view of the amendments and the above remarks, it is believed the case is now in condition for allowance and early notification of the same is requested.

If the Examiner believes a telephone conference would assist in the prosecution of the matter, the undersigned attorney can be contacted at the listed telephone number.

Very truly yours,

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